

Code Requirements for Design and Construction of Residential Decks

The Code requirements for residential decks presented in this paper are based on the author's interpretation of the *2020 Indiana Residential Code (IRC)*, and as such, the authority having jurisdiction (AHJ) may have a different interpretation of a code section as it applies to a residential deck. As codes are continually revised and adopted, the professional designer should determine the applicable code and applicable code provisions for a specific deck construction. The local jurisdiction should also be consulted as many jurisdictions have published guidelines, design requirements, and permitting procedures for residential decks.

In the paragraphs to follow, applicable *2020 IRC* sections are cited with commentary based on the construction and inspection experience of the author. Designers can benefit by the practical discussion as knowledge of common field problems can be used to prepare deck designs that are more constructible and reliable.

Live Loads

R301.5 Live load. *The minimum uniformly distributed live load shall be as provided in Table R301.5*

Table R301.5 requires decks to accommodate a uniformly distributed live load of 40 psf. Guardrails and handrails are to be capable of resisting a single 200 lbs. concentrated load applied in any direction at any point along the top of the rail. It also requires the rail infill (interior/intermediate rails) to resist a horizontally applied load of 50 psf.

Protection Against Decay

R317 Location Required *Protection of wood and wood-based products from decay shall be provided in the following locations by the use of naturally durable wood or wood that is preservative-treated in accordance with AWWA U1.*

R317.1.2 Ground Contact *All wood in contact with the ground. Embedded in concrete in direct contact with the ground, or embedded in concrete exposed to the weather that supports permanent structures intended for human occupancy shall be approved pressure-preservative-treated wood suitable for ground contact use...*

R317.1.4 Wood Columns *Wood columns shall be approved wood of natural decay resistance or be approved pressure-preservative-treated wood.*

Exceptions: 3. Deck posts supported by concrete piers or metal pedestals projecting not less than 1 inch above a concrete floor or 6 inches above exposed earth.

Wood in contact with the ground that supports decks must be pressure-preservative-treated (PPT) wood suitable for ground contact. Not all pressure treated lumber is suitable for ground contact. Wood encapsulated in concrete is exposed to “wetting” which causes decay in wood that is not PPT.

R317.3.1 Fasteners for preservative-treated wood. *Fasteners, including nuts and washers, and connectors in contact with preservative-treated wood shall be of hot-dipped, zinc-coated galvanized steel, silicon bronze, or copper. Staples shall be of stainless steel.*

Exception: ½ inch diameter or greater steel bolts.

Traditionally, the treated wood industry has recommended hot-dipped and stainless steel fasteners and connectors.

Protection Against Termites

R3318.1 Subterranean termite control methods. *In areas subject to damage from termites, protection shall be by one, or a combination of the following methods:*

3. Pressure-preservative-treated wood

AWPA Standard M4 recommends treating any cut, bored, or drilled surfaces of treated wood with a preservative solution. A good practice is to never put the cut end of a post in the ground or near grade.

Footings

R507.3 Footings *Decks shall be supported on concrete footings or other approved structural systems ...*

Posts can be set on concrete columns (Sonotube poured concrete) or set into the hole and filled with concrete (fully or partially) or simply backfilled.

R507.3.1 Minimum size *The minimum size of concrete footings shall be in accordance with Table R507.3.1.*

The normal rule of thumb for the post holes is three times the size of the post. For example, a 4x4 post would require a 12” diameter post hole.

R507.3.2 Minimum Depth Deck footings shall extend below the frost line specified in Table R301.2(1) in accordance with Section R403.1.4.1.

For Lake County, post holes have to be at least 36” deep.

Deck Posts

R507.4.1 Deck post to deck footing connections Where posts bear on concrete footings in accordance with Section R403 and Figure R507.3, lateral restraint shall be provided by manufactured connectors or a minimum post embedment of 12 inches.

An example of these connectors is a *Simpson Strong-Tie*

R507.4 Deck Posts For single-level wood-framed decks with beams sized in accordance with Table R507.5, deck posts size shall be in accordance with Table R507.4.

Deck Post Size	Maximum Height
4 x 4	6’-9” for a three-ply beam
4 x 4	8’-0” for one- & two-ply beams
4 x 6	8’-0”
6 x 6 & 8 x 8	14’-0”

Beams & Joists

R507.5 Deck Beams Maximum allowable spans for wood deck beams, as shown in Figure R507.5, shall be in accordance with Table R507.5. Beams shall be permitted to cantilever at each end up to one-fourth of the allowable beam span.

R507.5.1 Deck beam bearing The ends of beams shall have not less than 1-1/2 inches of bearing on wood and not less than 3 inches of bearing on concrete or masonry for the entire width of the beam.

The same rules apply to joists.

R507.5.2 Deck beam connections to wood posts shall be in accordance with Figures R507.5.1(1) and R507.5.1(2)....Bolts shall have washers under the head and nut.

R507.6 Deck joists Maximum allowable spans for wood deck joists, as shown in Figure R507.6, shall be in accordance with Table R507.6

Flashing

R703.4 *Approved corrosion-resistant flashing shall be applied shingle-fashion in a manner to prevent entry of water into the wall cavity or penetration of water to the building structural components. The flashing shall extend to the surface of the exterior wall finish. Approved corrosion-resistant flashings shall be installed at the following locations:*

5. Where exterior porches, decks, or stairs attach to a wall or floor assembly of wood-frame construction.

Aluminum has never been recommended for use as flashing with pressure treated lumber. Materials recommended include galvanized, copper, and plastics.

Wood Floor Framing

R502.8 Cutting, drilling, and notching. *Structural floor members shall not be cut, bored or notched in excess of the limitations specified in Figure R502.8.*

1. Notches are limited to 1/4 of the depth of the joist in the ends and 1/6 of the depth somewhere in the end 1/3. No notches in the middle 1/3 of the span is permitted. Notch length is limited to 1/3 of the depth.
2. Holes in lumber smaller than a 2x8 cannot have a diameter larger than 1/3 the depth, cannot be closer than 2" to any notch, the top or bottom of the joist, and to another hole and never in the middle 1/3 of the span.
3. Holes in lumber 2x8 and larger are limited in diameter to 1/2 the depth of the joist but at least 2" from the top or bottom and never in the middle 1/3 of the span.

R507.8 Vertical and lateral supports *Where supported by attachment to an exterior wall, decks shall be positively anchored to the primary structure and designed for both vertical and horizontal loads. Such attachment shall NOT be accomplished by the use of toenails or nails subject to withdrawal.*

Deck ledger boards shall be a minimum 2x8 attached to the house with bolts or lag screws which must be hot-dipped galvanized or stainless steel. Fastening joists to the ledger board will require connectors (joist hangers).

Stairways

R311.7.1 Width *Stairways shall be not less than 36 inches in clear width at all points above the permitted handrail height and below the required headroom height.*

R317.7.2 Headroom *The headroom in stairways shall be not less than 6 feet 8 inches measured vertically from the sloped line adjoining the tread nosing or from the floor surface of the landing or platform on that portion of the stairway.*

Minimum headroom can be an issue when perimeter stairs turn at a landing to terminate under the deck.

Risers

R311.7.5.1 Riser Height *The riser height shall be not more than 8-1/4 inches. The greatest riser height shall not exceed the smallest by more than 3/8 inch.*

Poorly cut stringers often exceed the allowable variance in height. Stairs that are built prior to patios being poured or landings being built frequently have considerably shorter first risers. Stepping off this step after descending the stairs may cause stumbles and falls. A person's mind creates a cadence when going up and down stairs. If this cadence is interrupted by a change in height, even as little as a half inch, a person may fall.

R311.7.5.1 Open Risers *At open risers, openings located more than 30 inches, as measured vertically, to the floor or grade below, shall not permit the passage of a 4-inch diameter sphere.*

Open risers are common with decks and the lack of infill is a common code violation. The purpose of the 4-inch diameter sphere is to prevent a small child from crawling through the opening and falling. Entrapment is also a concern.

R311.7.5.2 Tread Depth *The tread depth shall be not less than 9 inches. The greatest tread depth within any flight of stairs shall not exceed the smallest by more than 3/8 inch.*

Code required details, such as this one, should be specified on the plans by the design professional.

R311.7.5.3 Nosings *Nosings at treads, landings, and floors of stairways shall have a radius of curvature at the nosing not greater than 9/16 inch or a bevel not greater than 1/2 inch. A nosing projection not less than 3/4 inch and not more than 1-1/4 inches shall be provided on stairways. The greatest nosing projection shall not exceed the smallest nosing projection by more than 3/8 inch within a stairway.*

R311.7.6 Landings for Stairways *There shall be a floor or landing at the top and bottom of each stairway. The width perpendicular to the direction of travel shall be not less than the width of the flight served. Where the stairway has a straight run, the depth in the direction of travel shall be not less than 36 inches.*

Landings are frequently concrete pads placed after the deck and stairs are built. The required 36-inch dimension in the direction of travel is measured from the nose of the lowest tread.

Handrails

R311.7.8 Handrails *Handrails shall be provided on not less than one side of each flight of stairs with four or more risers.*

R311.7.8.1 Height *Handrail height, measured vertically from the sloped plane adjoining the tread nosing, or finish surface of ramp slope, shall be not less than 34 inches and not more than 38 inches.*

R311.7.8.4 Continuity *Handrails shall be continuous for the full length of the flight, from a point directly above the top riser of the flight to a point directly above the lowest riser of the flight. Handrail ends shall be returned or shall terminate in newel posts or safety terminals.*

R311.7.8.5 Grip Size *Required handrails shall be of one of the following types or provide equivalent grasp-ability.*

Type I. Handrails with a circular cross section shall have an outside diameter of not less than 1-1/4 inches and not greater than 2 inches. If the handrail is not circular, it shall have a perimeter of not less than 4 inches and not greater than 6-1/4 inches and a cross section of not more than 2-1/4 inches.

Type II. Handrails with a perimeter greater than 6-1/4 inches shall have a graspable finger recess area on both sides of the profile.

The ability to grasp the typical “handrail” on decks is an important issue. However you install them, 2x4’s and 2x6’s do NOT meet the criteria.

Guardrails

R312.1.1 & 312.1.2 Guards *Guards shall be provided for those portions of open-sided walking surfaces, including stairs, ramps, and landings that are located more than 30 inches measured vertically to the floor or grade below at any point within 36 inches horizontally to the edge of the open side. Required guards...shall be not less than 36 inches in height....*

When the height of a deck exceeds 30 inches above grade, a 36 inch guard is required. Lower rails can create a tumbling over effect. (Caution: The height requirement of the 2012 International Building Code (IBC) for commercial construction is 42 inches.

R312.1.3 Opening limitations *Required guards shall not have openings from the walking surface to the required guard height that allow passage of a sphere 4 inches in diameter.*